

PART J-1 PHYSICAL AGENTS

WAC

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WAC 296-62-090 Physical agents.

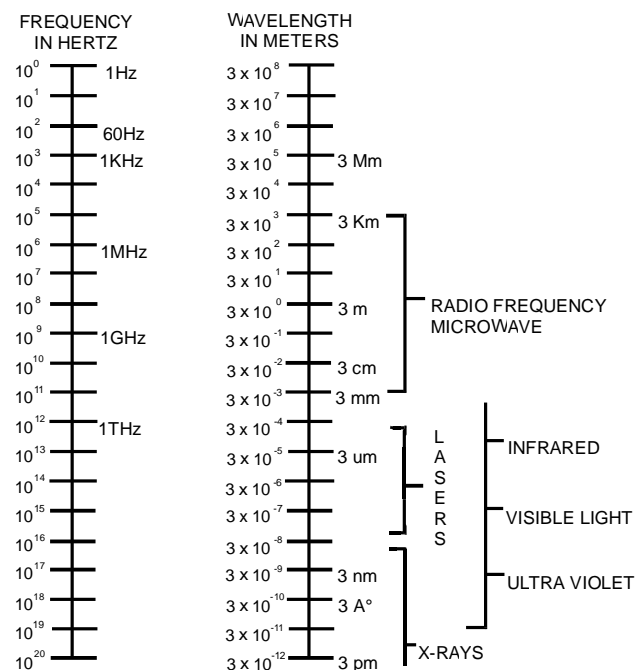
[Order 73-3, 296-62-090, filed 5/7/73; Order 70-8, 296-62-090, filed 7/31/70, effective 9/1/70; Rule 9.010, effective 8/1/63.]

WAC 296-62-09001 Definitions.

- (1) **“Physical agents”** shall mean, but are not limited to: Illumination, ionizing radiation, nonionizing radiation, pressure, vibration, temperature and humidity, and noise.
- (2) **“Nonionizing radiation”** as related to industrial sources, means electromagnetic radiation within the spectral range of approximately 200 nanometers to 3 kilometers including ultraviolet, visible, infrared and radiofrequency/microwave radiation. The electromagnetic spectrum is shown graphically in Figure 1 below.

ELECTROMAGNETIC SPECTRUM

Figure 1



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- (3) **Pressure is a barometric force.** Positive pressure would be that above 14.7 lbs. per square inch absolute and negative pressure would be that below 14.7 lbs. per square inch absolute. 14.7 lbs. per square inch equals 760 mm. mercury.
- (4) **“Vibration”** means rapid movement to and fro or oscillating movement.
- (5) **“Noise”** means unwanted sound or loud discordant or disagreeable sound or sounds.
- (6) **“Temperature”** means the degree of hotness or coldness measured by use of a thermometer.
- (7) **“Radiant heat”** means infrared radiation emitted from hot surfaces.
- (8) **“Relative humidity”** means the percent of moisture in the air compared to the maximum amount of moisture the air could contain at the same temperature.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 85-01-022 (Order 84-24), 296-62-09001, filed 12/11/84; Order 73-3, 296-62-09001, filed 5/7/73.]

WAC 296-62-09004 Ionizing radiation.

- (1) **Definitions** applicable to this section.

Note: Definitions also appear in some subsections.

- (a) **“Radiation”** includes alpha rays, beta rays, gamma rays, x-rays, neutrons, high-speed electrons, high-speed protons, and other atomic particles; but such term does not include sound or radio waves, or visible light, or infrared or ultraviolet light.
- (b) **“Radioactive material”** means any material which emits, by spontaneous nuclear disintegration, corpuscular or electromagnetic emanations.
- (c) **“Restricted area”** means any area access to which is controlled by the employer for purposes of protection of individuals from exposure to radiation or radioactive materials.
- (d) **“Unrestricted area”** means any area access to which is not controlled by the employer for purposes of protection of individuals from exposure to radiation or radioactive materials.
- (e) **“Dose”** means the quantity of ionizing radiation absorbed, per unit of mass, by the body or by any portion of the body. When the provisions in this section specify a dose during a period of time, the dose is the total quantity of radiation absorbed, per unit of mass, by the body or by any portion of the body during such period of time. Several different units of dose are in current use. Definitions of units used in this section are set forth in subdivisions (f) and (g) of this subsection.
- (f) **“Rad”** means a measure of the dose of any ionizing radiation to body tissues in terms of the energy absorbed per unit of mass of the tissue. One rad is the dose corresponding to the absorption of 100 ergs per gram of tissue (1 millirad (mrad) = 0.001 rad).
- (g) **“Rem”** means a measure of the dose of any ionizing radiation to body tissue in terms of its estimated biological effect relative to a dose of 1 roentgen (r) of x-rays (1 millirem (mrem) = 0.001 rem). The relation of the rem to other dose units depends upon the biological effect under consideration and upon the conditions for irradiation. Each of the following is considered to be equivalent to a dose of 1 rem:
 - (i) A dose of 1 roentgen due to x- or gamma radiation;

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- (ii) A dose of 1 rad due to x-, gamma, or beta radiation;
- (iii) A dose of 0.1 rad due to neutrons or high energy protons;
- (iv) A dose of 0.05 rad due to particles heavier than protons and with sufficient energy to reach the lens of the eye;
- (v) If it is more convenient to measure the neutron flux, or equivalent, than to determine the neutron dose in rads, as provided in item (iii) of this subdivision, 1 rem of neutron radiation may, for purposes of the provisions in this section be assumed to be equivalent to 14 million neutrons per square centimeter incident upon the body; or, if there is sufficient information to estimate with reasonable accuracy the approximate distribution in energy of the neutrons, the incident number of neutrons per square centimeter equivalent to 1 rem may be estimated from the following table:

Neutron Flux Dose Equivalents		
Neutron Energy (million electron volts (Mev))	Number of Neutrons per Square centimeter Equivalent to a Dose of 1 rem (neutron/cm²)	Average flux To deliver 100 millirem in 40 hours (neutrons/cm² per sec.)
Thermal	970 X 10(6)	670
0.0001	720 X 10(6)	500
0.005	820 X 10(6)	570
0.02	400 X 10(6)	280
0.1	120 X 10(6)	80
0.5	43 X 10(6)	30
1.0	26 X 10(6)	18
2.5	29 X 19(6)	20
5.0	26 X 10(6)	18
7.5	24 X 10(6)	17
10	24 X 10(6)	17
10 to 30	14 X 10(6)	10

- (h) For determining exposures to x- or gamma rays up to 3 Mev., the dose limits specified in this section may be assumed to be equivalent to the “air dose.” For the purpose of this section **“air dose”** means that the dose is measured by a properly calibrated appropriate instrument in air at or near the body surface in the region of the highest dosage rate.
- (i) **“Curie”** means a unit of measurement of radioactivity. One curie (Ci) is that quantity of radioactive material which decays at the rate of 2.2×10^{12} disintegrations per minute (dpm).
 - (i) One millicurie (mCi) = 10^{-3} Ci
 - (ii) One microcurie (uCi) = 10^{-6} Ci
 - (iii) One nanocurie (nCi) = 10^{-9} Ci
 - (iv) One picocurie (pCi) = 10^{-12} Ci

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- (2) **Nuclear Regulatory Commission licensees--**NRC contractors operating NRC plants and facilities.
- (a) Any employer who possesses or uses source material, byproduct material, or special nuclear material, as defined in the Atomic Energy Act of 1954, as amended, under a license issued by the Nuclear Regulatory Commission and in accordance with the requirements of chapter 402-24 WAC shall be deemed to be in compliance with the requirements of this section with respect to such possession and use.
 - (b) NRC contractors operating NRC plants and facilities: Any employer who possesses or uses source material, byproduct material, special nuclear material, or other radiation sources under a contract with the Nuclear Regulatory Commission for the operation of NRC plants and facilities and in accordance with the standards, procedures, and other requirements for radiation protection established by the commission for such contract pursuant to the Atomic Energy Act of 1954 as amended (42 U.S.C. 2011 et seq.) shall be deemed to be in compliance with the requirements of this section with respect to such possession and use.
 - (c) State licensees or registrants:
 - (i) Atomic Energy Act sources. Any employer who possesses or uses source material, byproduct material, or special nuclear material, as defined in the Atomic Energy Act of 1954, as amended (42 U.S.C. 2011 et seq.), and has registered such sources with the state shall be deemed to be in compliance with the radiation requirements of this section, insofar as his possession and use of such material is concerned.
 - (ii) Other sources. Any employer who possesses or uses radiation sources other than source material, byproduct material, or special nuclear material, as defined in the Atomic Energy Act of 1954, as amended (42 U.S.C. 2011 et seq.), and has registered such sources with the state shall be deemed to be in compliance with the radiation requirements of this section insofar as his possession and use of such material is concerned.
- (3) **Exposure of individuals to radiation in restricted areas.**
- (a) Except as provided in subdivision (b) of this subsection, no employer shall possess, use, or transfer sources of ionizing radiation in such a manner as to cause any individual in a restricted area to receive in any period of one calendar quarter from sources in the employer's possession or control a dose in excess of the limits specified in the following table:

EXPOSURE IN RESTRICTED AREAS		Rems per Calendar Quarter
Whole body. Head and trunk, active blood forming organs, lens of eyes, or gonads.		1-1/4
Hand and forearms, feet and ankles.		18-3/4
Skin of whole body.		7-1/2

- (b) An employer may permit an individual in a restricted area to receive doses to the whole body greater than those permitted under subdivision (a) of this subsection, so long as:
 - (i) During any calendar quarter the dose to the whole body shall not exceed 3 rem; and

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- (ii) The dose to the whole body, when added to the accumulated occupational dose to the whole body, shall not exceed 5 (N-18) rems, where “N” equals the individual's age in years at his last birthday; and
 - (iii) The employer maintains adequate past and current exposure records which show that the addition of such a dose will not cause the individual to exceed the amount authorized in this subdivision. As used in this subdivision “Dose to the whole body” shall be deemed to include any dose to the whole body, gonad, active blood-forming organs, head and trunk, or lens of the eye.
 - (c) No employer shall permit any employee who is under 18 years of age to receive in any period of one calendar quarter a dose in excess of 10 percent of the limits specified in the preceding table entitled “exposure in restricted areas.”
 - (d) **“Calendar quarter”** means any 3-month period determined as follows:
 - (i) The first period of any year may begin on any date in January: Provided, That the second, third and fourth periods accordingly begin on the same date in April, July, and October, respectively, and that the fourth period extends into January of the succeeding year, if necessary to complete a 3-month quarter. During the first year of use of this method of determination, the first period for that year shall also include any additional days in January preceding the starting date for the first period; or
 - (ii) The first period in a calendar year of 13 complete, consecutive calendar weeks; the second period in a calendar year of 13 complete consecutive weeks; the third period in a calendar year of 13 complete, consecutive calendar weeks; the fourth period in a calendar year of 13 complete, consecutive calendar weeks. If at the end of a calendar year there are any days not falling within a complete calendar week of that year, such days shall be included within the last complete calendar week of that year. If at the beginning of any calendar year there are days not falling within a complete calendar week of that year, such days shall be included within the last complete calendar week of the previous year; or
 - (iii) The four periods in a calendar year may consist of the first 14 complete, consecutive calendar weeks; the next 12 complete, consecutive calendar weeks, the next 14 complete, consecutive calendar weeks, and the last 12 complete, consecutive calendar weeks. If at the end of a calendar year there are any days not falling within a complete calendar week of that year, such days shall be included (for purposes of this section) within the last complete calendar week of the year. If at the beginning of any calendar year there are days not falling within a complete calendar week of that year, such days shall be included (for purposes of this section) within the last complete week of the previous year.
 - (e) No employer shall change the method used by him to determine calendar quarters except at the beginning of a calendar year.
- (4) **Exposure to airborne radioactive material.**
- (a) No employer shall possess, use or transport radioactive material in such a manner as to cause any employee, within a restricted area, to be exposed to airborne radioactive material in an average concentration in excess of the limits specified in Table I of WAC 402-24-220, Appendix A. The limits given in Table I are for exposure to the concentrations specified for 40 hours in any workweek of 7 consecutive days. In any such period where the number of hours of exposure is less than 40 the limits specified in the table may be increased proportionately. In any such period where the number of hours of exposure is greater than 40, the limits specified in the table shall be decreased proportionately.

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- (b) No employer shall possess, use, or transfer radioactive material in such a manner as to cause any individual within a restricted area, who is under 18 years of age, to be exposed to airborne radioactive material in an average concentration in excess of the limits specified in Table II of WAC 402-24-220, Appendix A.

For purposes of this subdivision, concentrations may be averaged over periods not greater than 1 week.

- (c) **“Exposed”** as used in this subdivision means that the individual is present in an airborne concentration. No allowance shall be made for the use of protective clothing or equipment, or particle size.

(5) Precautionary procedures and personal monitoring.

- (a) Every employer shall make such surveys as may be necessary for him to comply with the provisions in this section. **“Survey”** means an evaluation of the radiation hazards incident to the production, use, release, disposal, or presence of radioactive materials or other sources of radiation under a specific set of conditions. When appropriate, such evaluation includes a physical survey of the location of materials and equipment, and measurements of levels of radiation or concentrations of radioactive material present.
- (b) Every employer shall supply appropriate personnel monitoring equipment, such as film badges, pocket chambers, pocket dosimeters, or film rings, to, and shall require the use of such equipment by:
 - (i) Each employee who enters a restricted area under such circumstances that he receives, or is likely to receive, a dose in any calendar quarter in excess of 25 percent of the applicable value specified in subsection (3)(a) of this section; and
 - (ii) Each employee under 18 years of age who enters a restricted area under such circumstances that he receives, or is likely to receive a dose in any calendar quarter in excess of 5 percent of the applicable value specified in subsection (3)(a) of this section; and
 - (iii) Each employee who enters a high radiation area.
- (c) As used in this section:
 - (i) **“Personnel monitoring equipment”** means devices designed to be worn or carried by an individual for the purpose of measuring the dose received (e.g., film badges, pocket chambers, pocket dosimeters, film rings, etc.);
 - (ii) **“Radiation area”** means any area, accessible to personnel, in which there exists radiation at such levels that a major portion of the body could receive in any 1 hour a dose in excess of 5 millirem, or in any 5 consecutive days a dose in excess of 100 millirem; and
 - (iii) **“High radiation area”** means any area, accessible to personnel, in which there exists radiation at such levels that a major portion of the body could receive in any one hour a dose in excess of 100 millirem.

(6) Caution signs, labels and signals.

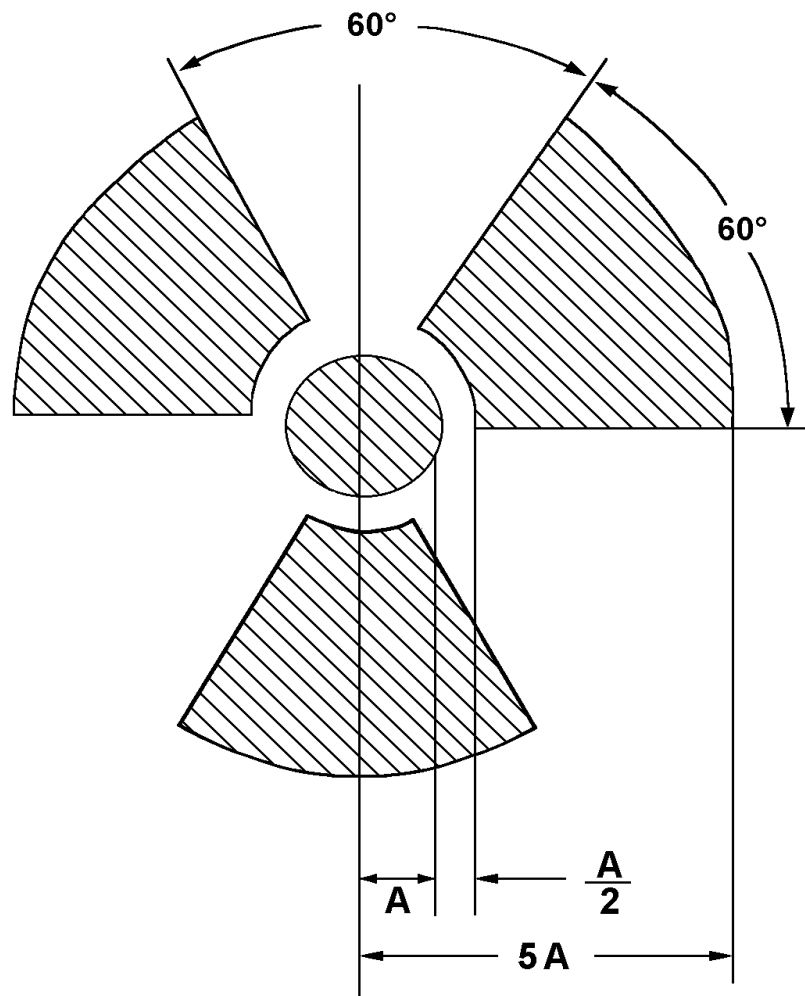
- (a) General.

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- (i) Symbols prescribed by this subsection shall use the conventional radiation caution colors (magenta or purple on yellow background). The symbol prescribed by this subsection is the conventional three-bladed design:

RADIATION SYMBOL

1. Cross-hatched area is to be magenta or purple.
2. Background is to be yellow.



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- (ii) In addition to the contents of signs and labels prescribed in this subsection, employers may provide on or near such signs and labels any additional information which may be appropriate in aiding individuals to minimize exposure to radiation or to radioactive material.
- (b) Radiation area. Each radiation area shall be conspicuously posted with a sign or signs bearing the radiation caution symbol described in subdivision (a) of this subsection and the words:

**CAUTION
RADIATION AREA**

- (c) High radiation area.
 - (i) Each high radiation area shall be conspicuously posted with a sign or signs bearing the radiation caution symbol and the words:

**CAUTION
HIGH RADIATION AREA**
 - (ii) Each high radiation area shall be equipped with a control device which shall either cause the level of radiation to be reduced below that at which an individual might receive a dose of 100 millirems in 1 hour upon entry into the area or shall energize a conspicuous visible or audible alarm signal in such a manner that the individual entering and the employer or a supervisor of the activity are made aware of the entry. In the case of a high radiation area established for a period of 30 days or less, such control device is not required.
- (d) Airborne radioactivity area.
 - (i) As used in the provisions of this section, “**airborne radioactivity area**” means:
 - (A) Any room, enclosure, or operating area in which airborne radioactive materials, composed wholly or partly of radioactive material, exist in concentrations in excess of the amounts specified in column 1 of Table I of WAC 402-24-220, Appendix A.
 - (B) Any room, enclosure, or operating area in which airborne radioactive materials exist in concentrations which, averaged over the number of hours in any week during which individuals are in the area, exceed 25 percent of the amounts specified in column 1 of Table I of WAC 402-24-220, Appendix A.
 - (ii) Each airborne radioactivity area shall be conspicuously posted with a sign or signs bearing the radiation caution symbol described in subdivision (a) of this subsection and the words:

**CAUTION
AIRBORNE RADIOACTIVITY AREA**

- (e) Additional requirements.
 - (i) Each area or room in which radioactive material is used or stored and which contains any radioactive material (other than natural uranium or thorium) in any amount exceeding 10 times the quantity of such material specified in WAC 402-24-230, Appendix B shall be conspicuously posted with a sign or signs bearing the radiation caution symbol described in subdivision (a) of this subsection and the words:

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**CAUTION
RADIOACTIVE MATERIALS**

- (ii) Each area or room in which natural uranium or thorium is used or stored in an amount exceeding 100 times the quantity of such material specified in chapter 402-24 WAC shall be conspicuously posted with a sign or signs bearing the radiation caution symbol described in subdivision (a) of this subsection and the words:

**CAUTION
RADIOACTIVE MATERIALS**

- (f) Containers.
 - (i) Each container in which is transported, stored, or used a quantity of any radioactive material (other than natural uranium or thorium) greater than the quantity of such material specified in WAC 402-24-230, Appendix B shall bear a durable, clearly visible label bearing the radiation caution symbol described in subdivision (a) of this subsection and the words:

**CAUTION
RADIOACTIVE MATERIALS**

- (ii) Each container in which natural uranium or thorium is transported, stored, or used in a quantity greater than 10 times the quantity specified in WAC 402-24-230, Appendix B shall bear a durable, clearly visible label bearing the radiation caution symbol described in subdivision (a) of this subsection and the words:

**CAUTION
RADIOACTIVE MATERIALS**

- (iii) Notwithstanding the provisions of items (i) and (ii) of this subdivision a label shall not be required:
 - (A) If the concentration of the material in the container does not exceed that specified in column 2 of Table I of WAC 402-24-220, Appendix A.
 - (B) For laboratory containers, such as beakers, flasks, and test tubes, used transiently in laboratory procedures, when the user is present.
- (iv) Where containers are used for storage, the labels required in this subdivision shall state also the quantities and kinds of radioactive materials in the containers and the date of measurement of the quantities.

(7) Immediate evacuation warning signal.

- (a) Signal characteristics.
 - (i) The signal shall be a midfrequency complex sound wave amplitude modulated at a subsonic frequency. The complex sound wave in free space shall have a fundamental frequency f_1 between 450 and 500 hertz (Hz) modulated at a subsonic rate between 4 and 5 hertz.
 - (ii) The signal generator shall not be less than 75 decibels at every location where an individual may be present whose immediate, rapid, and complete evacuation is essential.

WAC 296-62-09004 (Cont.)

- (iii) A sufficient number of signal units shall be installed such that the requirements of item (i) of this subdivision are met at every location where an individual may be present whose immediate, rapid, and complete evacuation is essential.
 - (iv) The signal shall be unique in the plant or facility in which it is installed.
 - (v) The minimum duration of the signal shall be sufficient to insure that all affected persons hear the signal.
 - (vi) The signal-generating system shall respond automatically to an initiating event without requiring any human action to sound the signal.
- (b) Design objectives.
 - (i) The signal-generating system shall be designed to incorporate components which enable the system to produce the desired signal each time it is activated within one-half second of activation.
 - (ii) The signal-generating system shall be provided with an automatically activated secondary power supply which is adequate to simultaneously power all emergency equipment to which it is connected, if operation during power failure is necessary, except in those systems using batteries as the primary source of power.
 - (iii) All components of the signal-generating system shall be located to provide maximum practicable protection against damage in case of fire, explosion, corrosive atmosphere, or other environmental extremes consistent with adequate system performance.
 - (iv) The signal-generating system shall be designed with the minimum number of components necessary to make it function as intended, and should utilize components which do not require frequent servicing such as lubrication or cleaning.
 - (v) Where several activating devices feed activating information to a central signal generator, failure of any activating device shall not render the signal-generator system inoperable to activating information from the remaining devices.
 - (vi) The signal-generating system shall be designed to enhance the probability that alarm occurs only when immediate evacuation is warranted. The number of false alarms shall not be so great that the signal will come to be disregarded and shall be low enough to minimize personal injuries or excessive property damage that might result from such evacuation.
- (c) Testing.
 - (i) Initial tests, inspections, and checks of the signal-generating system shall be made to verify that the fabrication and installation were made in accordance with design plans and specifications and to develop a thorough knowledge of the performance of the system and all components under normal and hostile conditions.
 - (ii) Once the system has been placed in service, periodic tests, inspections, and checks shall be made to minimize the possibility of malfunction.
 - (iii) Following significant alterations or revisions to the system, tests and checks similar to the initial installation tests shall be made.

WAC 296-62-09004 (Cont.)

- (iv) Tests shall be designed to minimize hazards while conducting the tests.
- (v) Prior to normal operation the signal-generating system shall be checked physically and functionally to assure reliability and to demonstrate accuracy and performance. Specific tests shall include:
 - (A) All power sources.
 - (B) Calibration and calibration stability.
 - (C) Trip levels and stability.
 - (D) Continuity of function with loss and return of required services such as AC or DC power, air pressure, etc.
 - (E) All indicators.
 - (F) Trouble indicator circuits and signals, where used.
 - (G) Air pressure (if used).
 - (H) Determine that sound level of the signal is within the limit of item (a)(ii) of this subsection at all points that require immediate evacuation.
- (vi) In addition to the initial startup and operating tests, periodic scheduled performance tests and status checks must be made to insure that the system is at all times operating within design limits and capable of the required response. Specific periodic tests or checks or both shall include:
 - (A) Adequacy of signal activation device.
 - (B) All power sources.
 - (C) Function of all alarm circuits and trouble indicator circuits including trip levels.
 - (D) Air pressure (if used).
 - (E) Function of entire system including operation without power where required.
 - (F) Complete operational tests including sounding of the signal and determination that sound levels are adequate.
- (vii) Periodic tests shall be scheduled on the basis of need, experience, difficulty, and disruption of operations. The entire system should be operationally tested at least quarterly.
- (viii) All employees whose work may necessitate their presence in an area covered by the signal shall be made familiar with the actual sound of the signal--preferably as it sounds at their work location. Before placing the system into operation, all employees normally working in the area shall be made acquainted with the signal by actual demonstration at their work locations.

WAC 296-62-09004 (Cont.)

- (8) **Exceptions from posting requirements.** Notwithstanding the provisions of subsection (6) of this section:
- (a) A room or area is not required to be posted with a caution sign because of the presence of a sealed source, provided the radiation level 12 inches from the surface of the source container or housing does not exceed 5 millirem per hour.
 - (b) Rooms or other areas in onsite medical facilities are not required to be posted with caution signs because of the presence of patients containing radioactive material, provided that there are personnel in attendance who shall take the precautions necessary to prevent the exposure of any individual to radiation or radioactive material in excess of the limits established in the provisions of this section.
 - (c) Caution signs are not required to be posted at areas or rooms containing radioactive materials for periods of less than 8 hours: Provided, That
 - (i) The materials are constantly attended during such periods by an individual who shall take the precautions necessary to prevent the exposure of any individual to radiation or radioactive materials in excess of the limits established in the provisions of this section; and
 - (ii) Such area or room is subject to the employer's control.
- (9) **Exemptions for radioactive materials packaged for shipment.** Radioactive materials packaged and labeled in accordance with regulations of the Department of Transportation published in 49 CFR Chapter I, are exempt from the labeling and posting requirements of this section during shipment, provided that the inside containers are labeled in accordance with the provisions of subsection (6) of this section.
- (10) **Instruction of personnel, posting.**
- (a) Employers regulated by the Nuclear Regulatory Commission shall be governed by 10 CFR Part 20 standards. Employers conducting business in Washington state shall be governed by the requirements of the laws and regulations of the state. All other employers shall be regulated by the following:
 - (b) All individuals working in or frequenting any portion of a radiation area shall be informed of the occurrence of radioactive materials or of radiation in such portions of the radiation area; shall be instructed in the safety problems associated with exposure to such materials or radiation and in precautions or devices to minimize exposure; shall be instructed in the applicable provisions of this section for the protection of employees from exposure to radiation or radioactive materials; and shall be advised of reports of radiation exposure which employees may request pursuant to the regulations in this section.
 - (c) Each employer to whom this section applies shall post a current copy of its provisions and a copy of the operating procedures applicable to the work conspicuously in such locations as to insure that employees working in or frequenting radiation areas will observe these documents on the way to and from their place of employment, or shall keep such documents available for examination of employees upon request.
- (11) **Storage of radioactive materials.** Radioactive materials stored in a nonradiation area shall be secured against unauthorized removal from the place of storage.
- (12) **Waste disposal.** No employer shall dispose of radioactive material except as provided for in WAC 402-24-130.

WAC 296-62-09004 (Cont.)

(13) Notification of incidents.

- (a) Immediate notification. Each employer shall immediately notify the industrial hygiene section, division of industrial safety and health for employees not protected by the Nuclear Regulatory Commission by means of 10 CFR Part 20; subsection (2)(b) of this section by telephone or telegraph of any incident involving radiation which may have caused or threatens to cause:
 - (i) Exposure of the whole body of any individual to 25 rems or more of radiation; exposure of the skin of the whole body of any individual to 150 rems or more of radiation; or exposure of the feet, ankles, hands, or forearms of any individual to 375 rems or more of radiation; or
 - (ii) The release of radioactive material in concentrations which, if averaged over a period of 24 hours, would exceed 5,000 times the limit specified for such materials in Table II of WAC 402-24-220, Appendix A.
 - (iii) A loss of 1 working week or more of the operation of any facilities affected; or
 - (iv) Damage to property in excess of \$100,000.
- (b) Twenty-four hour notification. Each employer shall within 24 hours following its occurrence notify the industrial hygiene section, division of industrial safety and health, for employees not protected by the Nuclear Regulatory Commission by means of 10 CFR Part 20; subsection (2)(b) of this section, by telephone or telegraph of any incident involving radiation which may have caused or threatens to cause:
 - (i) Exposure of the whole body of any individual to 5 rems or more of radiation; exposure of the skin of the whole body of any individual to 30 rems or more of radiation; or exposure of the feet, ankles, hands, or forearms to 75 rems or more of radiation; or
 - (ii) A loss of 1 day or more of the operation of any facilities; or
 - (iii) Damage to property in excess of \$10,000.

(14) Reports of overexposure and excessive levels and concentrations.

- (a) In addition to any notification required by subsection (13) of this section each employer shall make a report in writing within 30 days to the industrial hygiene section division of industrial safety and health, for employees not protected by the Nuclear Regulatory Commission by means of 10 CFR Part 20; or under subsection (2)(b) of this section, of each exposure of an individual to radiation or concentrations of radioactive material in excess of any applicable limit in this section. Each report required under this subdivision shall describe the extent of exposure of persons to radiation or to radioactive material; levels of radiation and concentration of radioactive material involved, the cause of the exposure, levels of concentrations; and corrective steps taken or planned to assure against a recurrence.
- (b) In any case where an employer is required pursuant to the provisions of this subsection to report to the industrial hygiene section, division of industrial safety and health, any exposure of an individual to radiation or to concentrations of radioactive material, the employer shall also notify such individual of the nature and extent of exposure. Such notice shall be in writing and shall contain the following statement: "You should preserve this report for future reference."

WAC 296-62-09004 (Cont.)

(15) Records.

- (a) Every employer shall maintain records of the radiation exposure of all employees for whom personnel monitoring is required under subsection (5) of this section and advise each of his employees of his individual exposure on at least an annual basis.
- (b) Every employer shall maintain records in the same units used in tables in subsection (2) of this section and WAC 402-24-220, Appendix A.

(16) Disclosure to former employee of individual employee's record.

- (a) At the request of a former employee an employer shall furnish to the employee a report of the employee's exposure to radiation as shown in records maintained by the employer pursuant to subdivision (15)(a) of this section. Such report shall be furnished within 30 days from the time the request is made, and shall cover each calendar quarter of the individual's employment involving exposure to radiation or such lesser period as may be requested by the employee. The report shall also include the results of any calculations and analysis of radioactive material deposited in the body of the employee. The report shall be in writing and contain the following statement: "You should preserve this report for future reference."
- (b) The former employee's request should include appropriate identifying data, such as social security number and dates and locations of employment.

(17) (Reserved)

(18) Radiation standards for mining.

- (a) For the purpose of this subsection, a "working level" is defined as any combination of radon daughters in 1 liter of air which will result in the ultimate emission of 1.3×10^5 million electron volts of potential alpha energy. The numerical value of the "working level" is derived from the alpha energy released by the total decay of short-lived radon daughter products in equilibrium with 100 picocuries of radon 222 per liter of air. A working level month is defined as the exposure received by a worker breathing air at one working level concentration for $4\frac{1}{3}$ weeks of 40 hours each.
- (b) Occupational exposure to radon daughters in mines shall be controlled so that no individual will receive an exposure of more than 2 working level months in any calendar quarter and no more than 4 working level months in any calendar year. Actual exposures shall be kept as far below these values as practicable.
- (c)
 - (i) For uranium mines, records of environmental concentrations in the occupied parts of the mine, and of the time spent in each area by each person involved in an underground work shall be established and maintained. These records shall be in sufficient detail to permit calculations of the exposures, in units of working level months, of the individuals and shall be available for inspection by the industrial hygiene section, division of safety and health or their authorized representatives.
 - (ii) For other than uranium mines and for surface workers in all mines, item (i) of this subdivision will be applicable: Provided, however, That if no environmental sample shows a concentration greater than 0.33 working level in any occupied part of the mine, the maintenance of individual occupancy records and the calculation of individual exposures will not be required.
- (d)
 - (i) At the request of an employee (or former employee) a report of the employee's exposure to radiation as shown in records maintained by the employer pursuant to subdivision (c) of this subsection shall be furnished to him. The report shall be in writing and contain the following statement:

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“This report is furnished to you under the provisions of the state of Washington, Ionizing Radiation Safety and Health Standards (chapter 296-62 WAC). You should preserve this report for future reference.”

- (ii) The former employee's request should include appropriate identifying data, such as Social Security number and dates and locations of employment. See tables in WAC 402-24-220, Appendix A and 402-24-230, Appendix B.

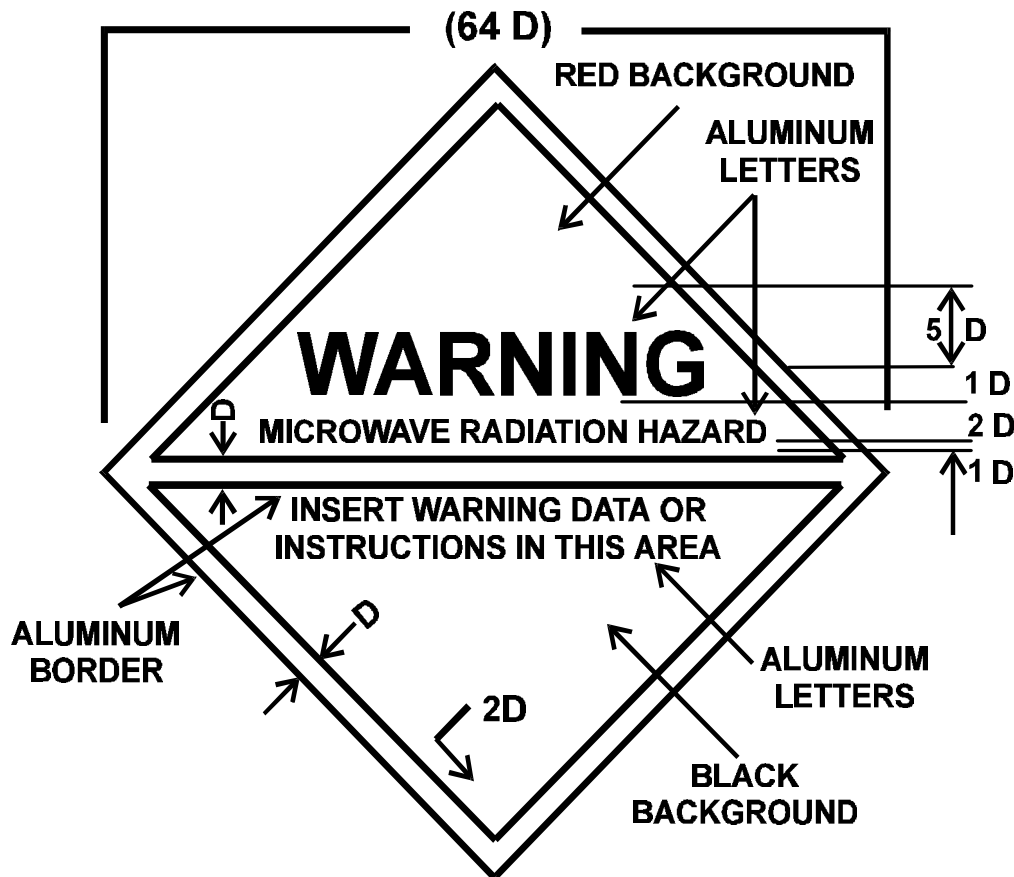
[Statutory Authority: RCW 49.17.040 and 49.17.050. 85-01-022 (Order 84-24), 296-62-09004, filed 12/11/84; Order 75-15, 296-62-09004, filed 4/18/75.]

WAC 296-62-09005 Nonionizing radiation.

- (1) **Introduction.** Employees shall be protected from exposure to hazardous levels of nonionizing radiation. Health standards have been established for ultraviolet, radiofrequency/microwave, and laser radiations which shall be used to promote a healthful working environment. These standards refer to levels of nonionizing radiation and represent conditions under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse effects. They are based on the best available information from experimental studies. Because of the wide variations in individual susceptibility, exposure of an occasional individual at, or even below, the permissible limit, may result in discomfort, aggravation of a preexisting condition, or physiological damage.
 - (a) Permissible exposure limits (PELs) refer to a time weighted average (TWA) of exposure for an 8-hour work day within a 40-hour workweek. Exceptions are those limits which are given a ceiling value.
 - (b) These PELs should be interpreted and applied only by technically qualified persons.
 - (c) Ceiling value. There are nonionizing radiations which produce physiological responses from short intense exposure and the PELs for these radiations are more appropriately based on this particular hazard. Nonionizing radiations with this type of hazard are best controlled by a ceiling value which is a maximum level of exposure which shall not be exceeded.
- (2) The employer shall establish and maintain a program for the control and monitoring of nonionizing radiation hazards. This program shall provide employees adequate supervision, training, facilities, equipment, and supplies, for the control and assessment of nonionizing radiation hazards.
- (3) **Radiofrequency/microwave radiation permissible exposure limits.**
 - (a) Definition: “**Partial body exposure**” means the case in which only the hands and forearms or the feet and legs below the knee are exposed.
 - (b) Warning symbol.
 - (i) The warning symbol for radiofrequency/microwave radiation shall consist of a red isosceles triangle above an inverted black isosceles triangle, separated and outlined by an aluminum color border. The words “Warning - Radiofrequency/microwave radiation hazard” shall appear in the upper triangle. See Figure 1.
 - (ii) All areas where entry may result in an exposure to radiofrequency/microwave radiation in excess of the PEL shall have a warning symbol prominently displayed at their entrance.
 - (iii) American National Standard Safety Color Code for Marking Physical Hazards and the Identification of Certain Equipment, Z53.1-1953, shall be used for color specification. All lettering and the border shall be of aluminum color.

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- (iv) The inclusion and choice of warning information or precautionary instructions is at the discretion of the user. If such information is included it shall appear in the lower triangle of the warning symbol.



1. Place handling and mounting instructions on reverse side.
2. D = Scaling Unit.
3. Lettering: Ratio of letter height to thickness of letter lines.

Upper triangle: 5 to 1 Large
 6 to 1 Medium
Lower triangle: 4 to 1 Small
 6 to 1 Medium

4. Symbol is square, triangles are right-angle isosceles.

- (c) These PELs refer to radiofrequency/microwave radiation exposures in the frequency range of 300 kHz to 100 GHz. Based on current knowledge, it is believed that workers may be exposed at these PELs without adverse health effects.
- (i) Table I gives the PELs in terms of the mean squared electric (E²) and magnetic (H²) field strengths and in terms of the equivalent plane-wave free-space power density, as a function of frequency.
 - (ii) The average exposure for any 6 minute (0.1 hour) period shall not exceed the PEL.
 - (iii) Measurements shall be made at distances of 5 cm or greater from any object.

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- (iv) For mixed or broadband fields at a number of frequencies for which there are different PELs, the fraction of the PEL incurred within each frequency interval shall be determined and the sum of these fractions shall not exceed unity.
- (v) PELs given in Table I for frequencies between 300 kHz and 1 GHz may be exceeded for partial body exposures if the output power of the radiating device is 7 watts or less.

Table I. Radiofrequency/Microwave Radiation Permissible Exposure Limis (PELs).			
Frequency(f)	Power Density* mW/cm²	Electric Field Strength Squared* V²/m²	Magnetic Field Strength Squared* A²/m²
0.3 to 3 MHz	100	400,000	2.5
3 to 30 MHz	900/f ²	4000(900/f ²)	0.025(900/f ²)
30 to 300 MHz	1.0	4000	0.025
300 to 1500 MHz	f/300	4000(f/300)	0.025(f/300)
1.5 to 100 GHz	5.0	20,0000	125

Note: f = frequency (MHz)

*Ceiling value`

(4) Laser radiation permissible exposure limits.

- (a) Definitions.
 - (i) **“Diffuse reflection”** means a change of the spatial distribution of a beam of radiation when it is reflected in many directions by a surface or medium.
 - (ii) **“Specular reflection”** means a mirrorlike reflection.
 - (iii) **“Accessible radiation”** means laser radiation to which human access is possible.
- (b) All lasers and laser systems shall be classified in accordance with the Federal Laser Product Performance Standards (21 CFR 1040.10) or, if manufactured prior to August 2, 1976, in accordance with ANSI Z136.1-1980.
 - (i) Class I. Laser systems that are considered to be incapable of producing damaging radiation levels and are thereby exempt from control measures. This is a no hazard category.
 - (ii) Class II. Visible wavelength laser systems that have a low hazard potential because of the expected aversion response. There is some possibility of injury if stared at. This is a low hazard category.
 - (iii) Class III. Laser systems in which intrabeam viewing of the direct beam or specular reflections of the beam may be hazardous. This class is further subdivided into IIIa and IIIb. This is a moderate hazard category.
 - (iv) Class IV. Laser systems whose direct or diffusely reflected radiation may be hazardous and where the beam may constitute a fire hazard. Class IV systems require the use of controls that prevent exposure of the eye and skin to specular or diffuse reflections of the beam. This is a high hazard category.

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- (c) Warning signs and classification labels shall be prepared in accordance with 21 CFR 1040.10 when classifying lasers and laser systems, and ANSI Z136.1 - 1980 when using classified lasers and laser systems. All signs and labels shall be conspicuously displayed.
 - (i) The signal word “caution” shall be used with all signs and labels associated with Class II and Class IIIa lasers and laser systems.
 - (ii) The signal word “danger” shall be used with all signs and labels associated with Class IIIb and Class IV lasers and laser systems.
 - (d) Personal protective equipment shall be provided at no cost to the employee and shall be worn whenever operational conditions or maintenance of lasers may result in a potentially hazardous exposure.
 - (i) Protective eyewear shall be specifically designed for protection against radiation of the wavelength and radiant energy of the laser or laser system. Ocular exposure shall not exceed the recommendations of ANSI Z136.1 - 1980.
 - (ii) For Class IV lasers and laser systems protective eyewear shall be worn for all operational conditions or maintenance which may result in exposures to laser radiation.
 - (e) Engineering controls shall be used whenever feasible to reduce the accessible radiation levels for Class IV lasers and laser systems to a lower classification level. These controls may include, but are not limited to: Protective housings, interlocks, optical system attenuators, enclosed beam paths, remote controls, beam stops, and emission delays with audible warnings.
 - (f) All employees who may be exposed to laser radiation shall receive laser safety training. The training shall ensure that the employees are knowledgeable of the potential hazards and control measures for the laser equipment in use.
- (5) **Ultraviolet radiation.**
- (a) These permissible exposure limits refer to ultraviolet radiation in the spectral region between 200 and 400 nanometer (nm) and represent conditions under which it is believed that nearly all workers may be repeatedly exposed without adverse effect. These values for exposure of the eye or the skin apply to ultraviolet radiation from arcs, gas, and vapor discharges, and incandescent sources, but do not apply to ultraviolet lasers or solar radiation. These levels should not be used for determining exposure of photosensitive individuals to ultraviolet radiation. These values shall be used in the control of exposure to continuous sources where the exposure relation shall not be less than 0.1 sec.
 - (b) The permissible exposure limit for occupational exposure to ultraviolet radiation incident upon skin or eye where irradiance values are known and exposure time is controlled are as follows:
 - (i) For the near ultraviolet spectral region (320 to 400 nanometer (nm)), total irradiance incident upon the unprotected skin or eye shall not exceed 1.0 milliwatt/sq. centimeter for periods greater than 103 seconds (approximately 16 minutes) and for exposure times less than 103 seconds shall not exceed one Joule/sq. centimeter.
 - (ii) For the actinic ultraviolet spectral region (200 - 315 nm), radiant exposure incident upon the unprotected skin or eye shall not exceed the values given in Table 4 within an 8-hour period.
 - (iii) To determine the effective irradiance of a broadband source weighted against the peak of the spectral effectiveness curve (270 nanometer (nm)), the following weighting formulas shall be used.

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$$E_{\text{eff}} = \Sigma (E\text{-Lambda}) (S\text{-Lambda}) (\Delta\text{-Lambda})$$

Where:

E_{eff} = effective irradiance relative to a monochromatic source at 270nm

E-Lambda = spectral irradiance in Watts/sq. centimeter/nanometer.

S-Lambda = relative spectral effectiveness (unitless)

Delta-Lambda = band width in nanometers

- (iv) Permissible exposure time in seconds for exposure to actinic ultraviolet radiation incident upon the unprotected skin or eye may be computed by dividing 0.003 Joules/sq. centimeter by E_{eff} in Watts/sq. centimeter. The exposure time may also be determined using Table 5 which provides exposure times corresponding to effective irradiances in $\mu\text{W}/\text{cm}^2$.

TABLE 4		
Relative PEL Wavelength Nanometer	Spectral Millijoules/sq. Centimeters	Effectiveness S Lambda
200	100	0.03
210	40	0.075
220	25	0.12
230	16	0.19
240	10	0.30
250	7.0	0.43
254	6.0	0.5
260	4.6	0.65
270	3.0	1.0
280	3.4	0.88
290	4.7	0.64
300	10	0.30
305	50	0.06
310	200	0.015
315	1000	0.003

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TABLE 5	
Duration of Exposure Per Day	Effective Irridance E_{eff} (μW/cm²)
8 hrs.	0.1
4 hrs	0.2
2 hrs	0.4
1 hr.	0.8
1/2 hr.	1.7
15 min.	3.3
10 min.	5
5 min.	10
1 min.	50
30 sec.	100
10 sec.	300
1 sec.	3,000
0.5 sec.	6,000
0.1 sec.	30,000

TABLE 6

Densities and Transmissions (in Percent); also Tolerances in Densities and Transmissions of Various Shades of Glasses for Protection Against Injurious Rays

(Shades 3 to 8, inclusive, are for use in goggles, shades 10 to 14, inclusive, for welder's helmets and face shields)

[CODIFICATION NOTE: The graphic presentation of this table has been varied slightly in order that it would fall within the printing specifications for the Washington Administrative Code. In the following table, the original table had columns relating to (1) "Optical Density" which is now "Part 1," (2) "Total Visible Luminous Transmittance" and "Maximum total Infrared" which are now "Part 2," (3) "Maximum Ultraviolet Transmission" which is now "Part 3," and (4) "Recommended Uses" which is now "Part 4." These columns were all positioned side by side. In the new WAC format these are split up into four separate tables.]

TABLE 6--Part 1 Optical Density			
Shade No.	Minimum O.D.	Standard O.D.	Maximum O.D.
3.0	.64	.857	1.06
4.0	1.07	1.286	1.49
5.0	1.50	1.714	1.92
6.0	1.93	2.143	2.35
7.0	2.36	2.572	2.78
8	2.79	3.000	3.21
9	3.22	3.429	3.63
10	3.64	3.857	4.06
11	4.07	4.286	4.49
12	4.50	4.715	4.92
13	4.93	5.143	5.35
14	5.36	5.571	5.78

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TABLE 6--Part 2 Total Visible Luminous Transmittance				
Shade No.	Maximum %	Standard %	Minimum %	Maximum Total Infrared %
3.0	22.9	13.9	8.70	9.0
4.0	8.51	5.18	3.24	5.0
5.0	3.16	1.93	1.20	2.5
6.0	1.18	.72	.45	1.5
7.0	.44	.27	.17	1.3
8	.162	.100	.062	1.0
9	.060	.037	.023	.8
10	.0229	.0139	.0087	.6
11	.0085	.0052	.0033	.5
12	.0032	.0019	.0012	.5
13	.00118	.00072	.00045	.4
14	.00044	.00027	.00017	.3

TABLE 6--Part 3 Maximum Ultraviolet Transmission				
Shade No.	313mu %	334mu %	365mu %	405mu %
3.0	.2	.2	.5	1.0
4.0	.2	.2	.5	1.0
5.0	.2	.2	.2	.5
6.0	.1	.1	.1	.5
7.0	.1	.1	.1	.5
8	.1	.1	.1	.5
9	.1	.1	.1	.5
10	.1	.1	.1	.5
11	.05	.05	.05	.1
12	.05	.05	.05	.1
13	.05	.05	.05	.1
14	.05	.05	.05	.1

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TABLE 6--Part 4	
Shade No.	Recommended Uses
3.0	Glare of reflected sunlight from snow, water, sand, etc., stray light from cutting and welding metal pouring and work around furnaces and foundries.
4.0 5.0	Light acetylene cutting and welding, light electric spot welding.
6.0 7.0	Acetylene cutting and medium welding, arc welding upto 30 amperes.
8 9	Heavy acetylene welding, arc cutting and welding between 30 and 75 amperes.
10 11	Arc cutting and welding between 75 and 200 amperes.
12 13	Arc cutting and welding between 200 and 400 amperes.
14	Arc cutting and welding above 400 amperes.

- a. American Standard Safety Code for the Protection of Heads, Eyes, and Respiratory Organs.
- b. Standard density is defined as the logarithms (base 10) of the reciprocal of the transmission. Shade number is determined by the density according to the relations:
Shade number = $7/3$ density + 1 with tolerances as given in the table.

Note: Safety glasses are available with lenses which protect the eyes against ultraviolet radiation.

[Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060. 92-22-067 (Order 92-06), 296-62-09005, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040 and 49.17.050. 85-01-022 (Order 84-24), 296-62-09005, filed 12/11/84. Statutory Authority: RCW 49.17.040. 80-16-029 (Order 80-22), 296-62-09005, filed 10/31/80. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 80-11-010 (Order 80-14), 296-62-09005, filed 8/8/80; Order 73-3, 296-62-09005, filed 5/7/73.]

WAC 296-62-09007 Pressure.

- (1) Employees exposed to pressures above normal atmospheric pressure which may produce physiological injury shall adhere to decompression schedules or other tables as are or may be adopted by the department of labor and industries: for example, state of Washington "safety standards for compressed air work" and "safety standards for commercial diving operations." The employer shall provide and supervise the use of decompression equipment and schedules in accordance with applicable requirements.
- (2) If no specific requirements prevail for an unusual condition, a plan based on the recommendations of professionally qualified advisors, experienced with hazards associated with such exposures, shall be followed by both the employer and employee.

[Statutory Authority: Chapter 49.17 RCW. 91-11-070 (Order 91-01), 296-62-09007, filed 5/20/91, effective 6/20/91; Order 73-3, 296-62-09007, filed 5/7/73.]

WAC 296-62-09009 Vibration. Reasonable precautions shall be taken to protect workmen against the hazardous effects of unavoidable exposure to vibrations.

[Order 73-3, 296-62-09009, filed 5/7/73.]

WAC 296-62-09013 Temperature, radiant heat, or temperature-humidity combinations.

- (1) Workmen subjected to temperature extremes, radiant heat, humidity, or air velocity combinations which, over a period of time, are likely to produce physiological responses which are harmful shall be afforded protection by use of adequate controls, methods or procedures, or protective clothing. This shall not be construed to apply to normal occupations under atmospheric conditions which may be expected in the area except that special provisions which are required by other regulations for certain areas or occupations shall prevail.

[Order 73-3, 296-62-09013, filed 5/7/73.]